NCT010657

## US Patent 5,611,049, Claim 1.

- 1. In a network of digital computers that includes a first plurality of an NDC that has an NDC buffer, a method for projecting images of Network Distributed Cache ("NDC") sites, each NDC site including a stored dataset from an NDC server terminator site into a second plurality of NDC client terminator sites in response to requests to plurality of client sites respectively to the second plurality of NDC concurrently access such stored dataset transmitted from a third client terminator sites, the method comprising the steps of:
- (a) the NDC receiving the request to access data in the stored dataset;
- if a projected image of data requested from the stored dataset is already (b) the NDC checking the NDC buffer at this NDC site to determine present there;
- data from this NDC site downstream to another NDC site closer to the (c) if the NDC buffer of this NDC site does not contain a projected image of all data requested from the stored dataset, and if the NDC site stored dataset, the NDC of this NDC site transmitting a request for receiving the request is not the NDC server terminator site for the NDC server terminator site for the stored dataset than the present NDC site;
- stored dataset, the NDC of the NDC server terminator site accessing the stored dataset to project an image of the requested data into the NDC image of all data requested from the stored dataset, and if the NDC site (d) if the NDC buffer of this NDC site does not contain a projected receiving the request is the NDC server terminator site for the buffer of the NDC server terminator site;
- downstream NDC site receiving the request contains a projected image (e) repeating the steps (a) through (d) until the NDC buffer of the of all requested data;
- data arrives at the NDC client terminator site, each NDC site that returns data upstream to the requesting NDC site retaining a copy of the returned data that the returning NDC site may subsequently transmit to an NDC returned the data, whereby images of the stored dataset may be projected the requested data, returning the requested data upstream to the NDC (f) each successive NDC site, having obtained a projected image of all concurrently from a single NDC site into the second plurality of NDC site from which the NDC site received the request until the requested site other than the NDC site to which the returning NDC site first client terminator sites; and
- (g) the NDC client terminator site, upon receiving the requested data, returning the requested data to the client site that requested access to the stored dataset.

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Advanced Development Group Senior Research Engineer RON LET

enhance network performance. Compethensive security restrictions, access controls, and content filtering are crucial aspects of securing the infinite and connecting to the Internet, but they exact an achituscal performance possibly in an environment where users are already fustrated by busy. Web servers and long their systems using the most cost-effective means available. Yet the wickspread deployment of Internet and intennet connections has infrased new requirements that seem to be in conflict with these efforts to Network engineers and administrators are constantly trying to agueeze the highest perferenance out of respirate times

access, in the prevens, this technology provides a performance foundating to support your network infrastructure and offset the performance penalty you pay for the necessary security controls and filtering. Novell's BorderManager uncludes an futernet object eache that significandly increases the speed of web

This Applicate provides an overview of Beeder/Marages's caching technology and discusses the advantages of caching in Intranet and Internet environments. It then describes three applications of Novell's Internet object cache that provide suparificant benefits to intranet and Internet users:

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.....Proxy cache hierarchies

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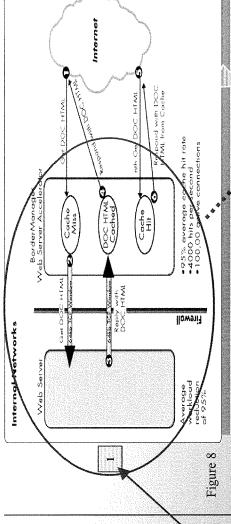
For more information on BonderManager and other Applyotes regarding these technologies, visit the Novell World Wide site at fitting

## What is Caching?

executing was extremely repetitive—staall portions of the cods would be processed over and over again. Using this insight to their advantage, they began storing the repetitive portions of their pregrams to a During the 1960s, composter designers discovered that much of the program code their systems were

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Internet



(c) if the NDC buffer of this NDC site does not contain a projected image of all data requested from the stored dataset, and if the NDC site receiving the request is not the NDC server terminator site for the stored dataset, the NDC of this NDC site transmitting a request for data from this NDC site downstream to another NDC site closer to the NDC server terminator site for the stored dataset than the present NDC site;

if a projected image of data requested from the stored dataset is already

present there;

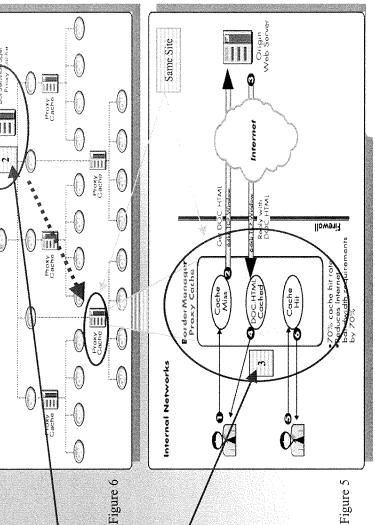
(b) the NDC checking the NDC buffer at this NDC site to determine

(a) the NDC receiving the request to access data in the stored dataset;

(d) if the NDC buffer of this NDC site does not contain a projected image of all data requested from the stored dataset, and if the NDC site receiving the request is the NDC server terminator site for the stored dataset, the NDC of the NDC server terminator site accessing the stored dataset to project an image of the requested data into the NDC buffer of the NDC server terminator site.

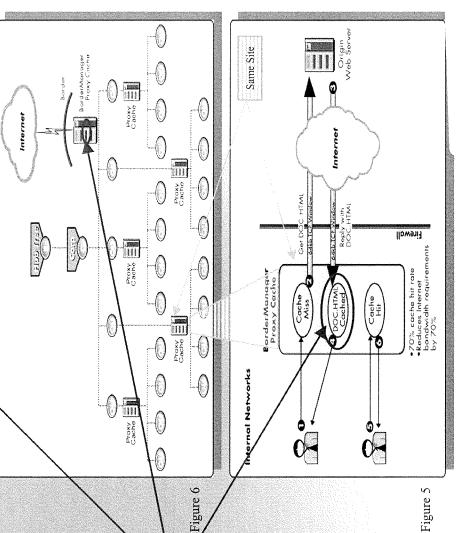
(e) repeating the steps (a) through (d) with the NDC buffer of the downstream NDC site receiving the request contains a projected image of all requested data;

(f) each successive NDC site, reging obtained a projected image of all the requested data, returning the requested data upstream to the NDC site from which the NDC site received the request until the requested data arrives at the NDC client terminator site, each NDC site that returned data upstream to the requesting NDC site retaining a copy of the returned data that the returning NDC site may subsequently transmit to ac NDC site owhich the returning NDC site first returned the data, whereby images of the stored dataset may be projected concurrently from a single NDC site into the second plurality of NDC client terminator sites; and





- present there;
- data from this NDC site downstream to another NDC site closer to the image of all data requested from the stored dataset, and if the NDC site (c) if the NDC buffer of this NDC site does not contain a projected stored dataset, the NDC of this NDC site transmitting a request for receiving the request is not the NDC server terminator site for the NDC server terminator site for the stored dataset than the present NDC site;
- stored dataset, the NDC of the NDC server terminator site accessing the (d) if the NDC buffer of this NDC site does not contain a projected image of all data requested from the stored dataset, and if the NDC site stored dataset to project an image of the requested data into the NDC receiving the request is the NDC server terminator site for the buffer of the NDC server terminator site;
- (c) repeating the steps (a) through (d) until the NDC buffer of the downstream NDC site receiving the request contains a projected image of all requested data;
- data upstream to the requesting NDC site retaining a copy of the returned data arrives at the NDC client terminator site, each NDC site that returns data that the returning NDC site may subsequently transmit to an NDC returned the data, whereby images of the stored dataset may be projected the requested data, returning the requested data upstream to the NDC each successive NDC site, having obtained a projected image of all concurrently from a single NDC site into the second plurality of NDC site from which the NDC site received the request until the requested site other than the NDC site to which the returning NDC site first client terminator sites; and



if a projected image of data requested from the stored dataset is already (b) the NDC checking the NDC buffer at this NDC site to determine

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- (b) the NDC checking the NDC buffer at this NDC site to determine if a projected image of data requested from the stored dataset is already present there;
- (c) if the NDC buffer of this NDC site does not contain a projected image of all data requested from the stored dataset, and if the NDC site receiving the request is not the NDC server terminator site for the stored dataset, the NDC of this NDC site transmitting a request for data from this NDC site downstream to another NDC site closer to the NDC server terminator site for the stored dataset than the present NDC site;

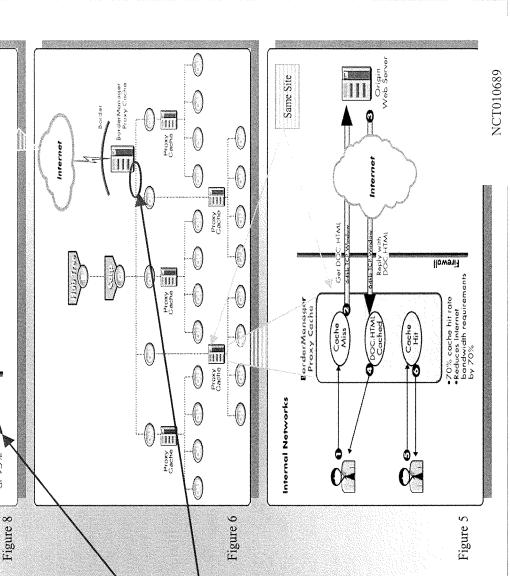
95% average coche hit rate
4000 hits per second
100,00 active connections

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Average workload reduction of 95%

- (d) if the NDC buffer of this NDC site does not contain a projected image of all data requested from the stored dataset, and if the NDC site receiving the request is the NDC server terminator site for the stored dataset, the NDC of the NDC server terminator site accessing the stored dataset to project an image of the requested data into the NDC buffer of the NDC server terminator site;
- (c) repeating the steps (a) through (d) until the NDC buffer of the downstream NDC site receiving the request contains a projecter mage of all requested data;

(f) each successive NDC site, having obtained a projected image of all the requested data, returning the requested data upstream to the NDC site from which the NDC site received the request until the requested data arrives at the NDC site the reminator site, each NDC site that returns data upstream to the requesting NDC site retaining a copy of the returned data that the returning NDC site may subsequently transmit to an NDC site other than the NDC site to which the returning NDC site first returned the data, whereby images of the stored dataset may be projected concurrently from a single NDC site into the second plurality of NDC client terminator sites, and



(a) the NDC receiving the request to access data in the stored dataset;

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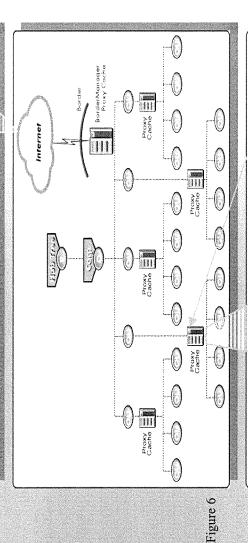
•95% average cache hit rate •4000 hits per second •100,00 active connections

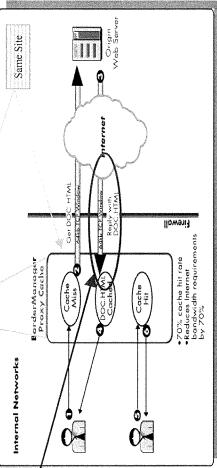
Firewall

Average workload reduction of 95%

Figure 8

- (b) the NDC checking the NDC buffer at this NDC site to determine if a projected image of data requested from the stored dataset is already present there;
- (c) if the NDC buffer of this NDC site does not contain a projected image of all data requested from the stored dataset, and if the NDC site receiving the request is not the NDC server terminator site for the stored dataset, the NDC of this NDC site transmitting a request for data from this NDC site downstream to another NDC site closer to the NDC server terminator site for the stored dataset than the present NDC site;
- (d) if the NDC buffer of this NDC site does not contain a projected image of all data requested from the stored dataset, and if the NDC site receiving the request is the NDC server terminator site for the stored dataset, the NDC of the NDC server terminator site accessing the stored dataset to project an image of the requested data into the NDC buffer of the NDC server terminator site.
- (e) repeating the steps (a) through (d) until the NDC buffer of the downstream NDC site receiving the request contains a projected image of all requested data;
- (f) each successive NDC site, having obtained a projected image of all the requested data, returning the requested data upstream to the NDC site from which the NDC site received the request until the requested data arrives at the NDC elient terminator site, each NDC site that returns data upstream to the requesting NDC site retaining a copy of the returned data that the returning NDC site may subsequently transmit to an NDC site other than the NDC site to which the returning NDC site first returned the data, whereby images of the stored dataset may be projected concurrently from a single NDC site into the second plurality of NDC client terminator sites; and







(b) the NDC checking the NDC buffer at this NDC site to determine
if a projected image of data requested from the stored dataset is already
present there;

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BorderManager Web Server Accelerator

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Respond with DCX

Cache

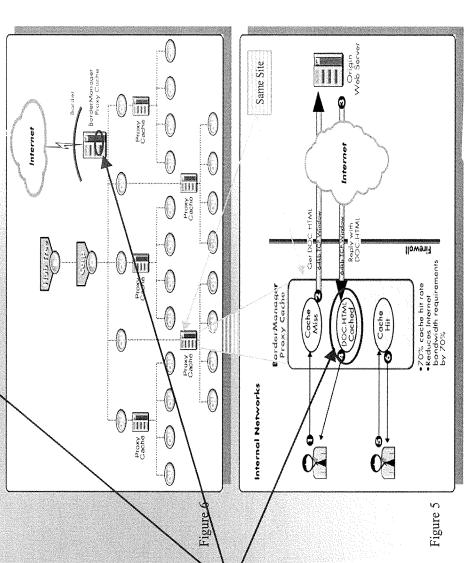
with.

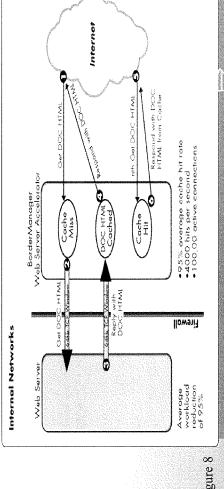
495% average cache hit rate
4000 hits per second
100,00 active connections

Mewall

Average workload reduction of 95%

- (c) if the NDC buffer of this NDC site does not contain a projected image of all data requested from the stored dataset, and if the NDC site receiving the request is not the NDC server terminator site for the stored dataset, the NDC of this NDC site transmitting a request for data from this NDC site downstream to another NDC site closer to the NDC server terminator site for the stored dataset than the present NDC site,
- (d) if the NDC buffer of this NDC site does not contain a projected image of all data requested from the stored dataset, and if the NDC site receiving the request is the NDC server terminator site for the stored dataset, the NDC of the NDC server terminator site accessing the stored dataset to project an image of the requested data into the NDC buffer of the NDC server terminator site;
- (e) repeating the steps (a) through (d) until the NDC buffer of the downstream NDC site receiving the request contains a projected image of all requested data;
- (f) each successive NDC site, having obtained a projected image of all the requested data, returning the requested data upstream to the NDC site from which the NDC site received the request until the requested data arrives at the NDC client terminator site, each NDC site that returns data upstream to the requesting NDC site retaining a copy of the returned data that the returning NDC site may subsequently transmit to an NDC site other than the NDC site to which the returning NDC site first returned the data, whereby images of the stored dataset may be projected concurrently from a single NDC site into the second plurality of NDC client terminator sites; and





if a projected image of data requested from the stored dataset is already

present there;

(b) the NDC checking the NDC buffer at this NDC site to determine.

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Figure 8

data from this NDC site downstream to another NDC site closer to the

NDC server terminator site for the stored dataset than the present

NDC site;

stored dataset, the NDC of this NDC site transmitting a request for receiving the request is not the NDC server terminator site for the

image of all data requested from the stored dataset, and if the NDC site

(c) if the NDC buffer of this NDC site does not contain a projected

Proxy Cacho Internet Proxy Proxy Cache Proxy Cache For example ... Proxy Cache Figure 6

Same Site Internet Z. ξŽ linewall Ger DC •70% cache hit rate •Reduces Internet bandwidth requirements by 70% Proxy Coche DOC.HTMI Cached Cache Cache Ó Internal Networks Figure 5

stored dataset, the NDC of the NDC server terminator site accessing the stored dataset to project an image of the requested data into the NDC (d) if the NDC buffer of this NDC site does not contain a projected image of all data requested from the stored dataset, and if the NDC site receiving the request is the NDC server terminator site for the buffer of the NDC server terminator site; (c) repeating the steps (a) through (d) until the NDC buffer of the downstream NDC site receiving the request contains a projected image of all requested data;

each successive NDC site, having obtained a projected image of all concurrently from a single NDC site into the second plurality of NDC the requested data, returning the requested data upstream to the NDo site from which the NDC site received the request until the requested site other than the NDC site to which the returning NDC site first client terminator sites; and

data arrives at the NDC client terminator site, each NDC site that returns data upstream to the requesting NDC site-retaining a copy of the returned data that the returning NDC site may subsequently transmit to an NDC returned the data, whereby images of the stored dataset may be projected



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•95% average coche hit rate •4000 hits per second •100,00 active connections

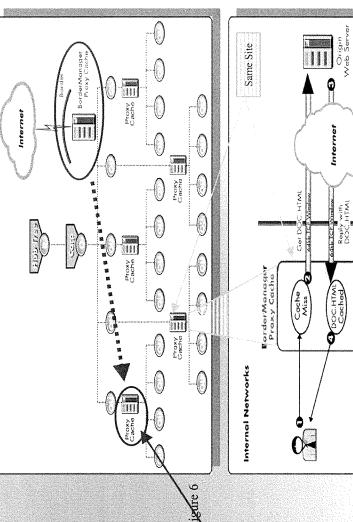
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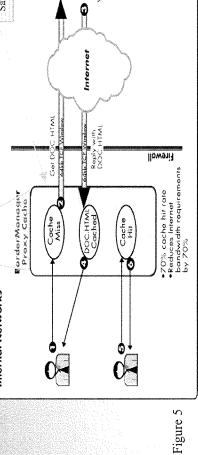
Average workload reduction of 95%

Figure 8

- if a projected image of data requested from the stored dataset is already (b) the NDC checking the NDC buffer at this NDC site to determine present there;
- image of all data requested from the stored dataset, and if the NDC site data from this NDC site downstream to another NDC site closer to the (c) if the NDC buffer of this NDC site does not contain a projected stored dataset, the NDC of this NDC site transmitting a request for receiving the request is not the NDC server terminator site for the NDC server terminator site for the stored dataset than the present NDC site;
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- (c) repeating the steps (a) through (d) until the NDC buffer of the downstream NDC site receiving the request contains a projected image of all requested data;

data arrives at the NDC client terminator site, each NDC site that returns data upstream to the requesting NDC site retaining a copy of the returned data that the returning NDC site may subsequently transmit to an NDC returned the data, whereby images of the stored dataset may be projected the requested data, returning the requested data upstream to the NDC each successive NDC site, having obtained a projected image of all concurrently from a single NDC site into the second plurality of NDC site from which the NDC site received the request until the requested site other than the NDC site to which the returning NDC site first client terminator sites; and





(a) the NDC receiving the request to access data in the stored dataset;

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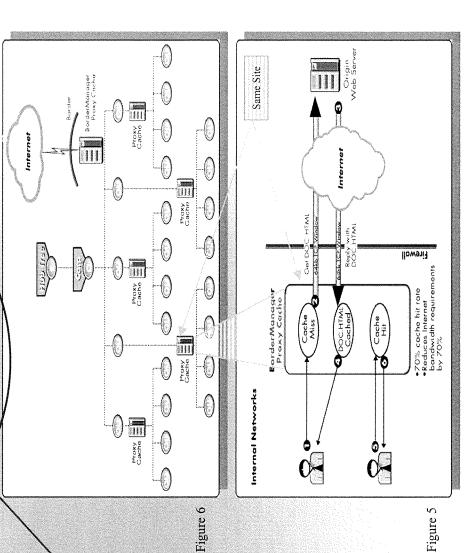
- (b) the NDC checking the NDC buffer at this NDC site to determine
  if a projected image of data requested from the stored dataset is already
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- (c) If the NDC buffer of this NDC site does not contain a projected image of all data requested from the stored dataset, and if the NDC site receiving the request is not the NDC server terminator site for the stored dataset, the NDC of this NDC site transmitting a request for data from this NDC site downstream to another NDC site closer to the NDC server terminator site for the stored dataset than the present NDC site;

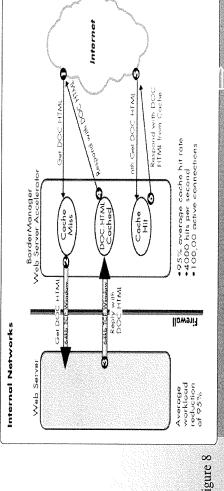
•95% average cache •4000 hits per secong •100,00 active congr

Firewall

Average workload reduction of 95%

- (d) if the NDC buffer of this NDC site does not contain a projected image of all data requested from the stored dataset, and if the NDC site receiving the request is the NDC server terminator site for the stored dataset, the NDC of the NDC server terminator site accessing the stored dataset to project an image of the requested data into the NDC buffer of the NDC.
- (e) repeating the steps (a) through (d) until the NDC buffer of the downstream NDC site receiving the request contains a projected image of all requested data;
- (f) each successive NDC site, having obtained a projected image of all the requested data, returning the requested data upstream to the NDC site from which the NDC site received the reguest until the requested data arrives at the NDC site received the reguest until the requested data arrives at the NDC client terminator site, each NDC site that returned data upstream to the requesting NDC site retaining a copy of the returned data that the returning NDC site for subsequently transmit to an NDC site other than the NDC site for which the returning NDC site first returned the data, whereby mages of the stored dataset may be projected concurrently from a single NDC site into the second plurality of NDC client terminator sites; and





if a projected image of data requested from the stored dataset is already

present there;

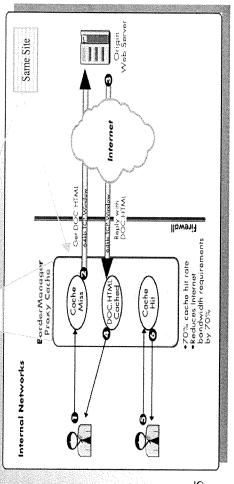
(b) the NDC checking the NDC buffer at this NDC site to determine

(a) the NDC receiving the request to access data in the stored dataset;

image of all data requested from the stored dataset, and if the NDC site

(c) if the NDC buffer of this NDC site does not contain a projected

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(c) repeating the steps (a) through (d) until the NDC buffer of the downstream NDC site receiving the request contains a projected image of all requested data;

data arrives at the NDC client terminator site, each NDC site that returns data upstream to the requesting NDC site retaining a copy of the returned data that the returning NDC site may subsequently transmit to an NDC the requested data, returning the requested data upstream to the NDC each successive NDC site, having obtained a projected image of all returned the data, whereby images of the stored dataset may be projecte concurrently from a single NDC site into the second plurality of NDC site from which the NDC site received the request until the requested site other than the NDC site to which the returning NDC site first client terminator sites; and

stored dataset, the NDC of the NDC server terminator site accessing the data from this NDC site downstream to another NDC site closer to the stored dataset to project an image of the requested data into the NDC image of all data requested from the stored dataset, and if the NDC site (d) If the NDC buffer of this NDC site does not contain a projected stored dataset, the NDC of this NDC site transmitting a request for receiving the request is not the NDC server terminator site for the NDC server terminator site for the stored dataset than the present receiving the request is the NDC server terminator site for the buffer of the NDC server terminator site; NDC site;

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